

by the behaviour of trees in sand; the only alteration produced in the soil by the heating must have been an alteration in the living organisms present in it. That bacteria are connected with root action has, of course, been established in certain special cases, but in these the connection consists of the bacteria being the means of augmenting the food supply of the plant; the present case is altogether different, for it appears as if the mere functioning of the roots was dependent on bacterial action. Such a conclusion would be one of far-reaching significance. Of course, the facts require much more examination and confirmation, but, even in their present state, they are sufficiently evident to warrant notification.

That two out of the nine trees in sterilised soil showed very little retardation in activity is not surprising, as there were many opportunities for the re-inoculation of the soil, the pots containing the trees having been exposed in the open since February 4, and no attempt having been made to sterilise the trees themselves before planting, though the roots were washed free from soil. The two exceptional trees were in earth which had been heated to the higher temperature; they were two out of six planted under these conditions. It may also be mentioned that heating to the lower temperature does not destroy all soil bacteria, indeed, it may increase the total bacterial contents; it is probably, therefore, a question of killing some particular bacteria which are connected with root activity.

SPENCER PICKERING.

### The Astronomical and Archæological Value of the Welsh Gorsedd.

FROM the very interesting communication of the Rev. John Griffith (May 2, p. 9) it would at first sight appear that the modern "Druids" had indeed preserved a tradition of the May year as well as of the solstitial year in connection with the circles set up by them for the performance of their ceremonies. I should be glad to think that this was the case, but I find considerable difficulty in connecting the modern circles with the ancient ones; there is no ancient circle which shows any sign of ever having possessed such an array of outlying stones as appears in the plan given by Mr. Griffith, and the outlying stones that remain do not always conform to it either; nor is there any ancient circle, except those in which a sepulchral cist forms the central point, and Stonehenge, which has a flat stone in the centre. The late "Myfyr Morganwg, Archdruid of Wales," set up a circle round the rocking stone at Pontypridd in the middle of the last century, but in place of the eight outlying stones figured by Mr. Griffith it has curved avenues forming the head and tail ends of a serpent, so it does not appear that modern "Druidic" authorities are agreed upon this important subject. "Myfyr Morganwg" also published a book in Welsh, the principal illustration to which represents a Druid standing on a flat stone (sometimes it is a three-legged dolmen), surrounded by a circle of twelve others, on which converge three rays of light coming from the north-east, east, and south-east, and forming, no doubt, the original model of the "broad arrow" and of the "Y cross," but without any outlying stones, though three smaller stones are represented in those lines inside the circle; three stones which may represent these, or may, with others there, be intended for an inner circle, also exist in his Pontypridd circle. The central stone for sitting or standing on seems to be a *sine quâ non* with the modern "Druids," but it is not found in ancient circles. There are upright stones in the middle of the circles at Callernish, Boscawen-un, the Strippie Stones, and the Marshpool or Hoar-stone circle (Shropshire), and there was one in the middle of the southern inner circles at Avebury, where also the middle of the northern inner circles was occupied by a "cove," or open shrine of three stones, as again was the case at Arborlow, but at none of these places, except perhaps in the Shropshire circle, could any man stand or sit on these stones, though he might stand in front of them. In the other great British circles (Stonehenge, which occupies a place by itself amongst them, excepted) there is nothing in the centre nor any appearance of there ever having been

anything, although there is reason to believe that whatever was done in them was done at or about the centre.

I am therefore inclined to think that the type of circle represented by Mr. Griffith, and probably much of the ritual connected with it, were evolved during the process of "re-codifying or otherwise dealing with the bardic traditions," which, as he says, took place between the twelfth and nineteenth centuries, when, as he also says, a "voluminous body of traditions grew up," and that whatever old ideas may be preserved amongst those traditions have got there rather in an accidental sort of way than by continuous use or direct descent. The traditions, however, though of no real authority in matters of detail, are not without value as indications of an opinion of very great antiquity as to the use of the ancient circles.

The number nineteen occurs at Stonehenge, Dawns Maen, Boscawen-un, the Cosdon circle (Dartmoor), and in the proportionate measurements of Stanton Drew. It probably refers to the cycle of nineteen years in which the sun and moon were thought to return to the same relative place in the heavens, and which was known in the fourth century B.C., if not, indeed, much earlier, in the island described by Hecataeus, usually identified with Great Britain.

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I AM glad that a brief summary of the evidence for the antiquity of the Welsh Gorsedd has interested Mr. A. L. Lewis.

(1) The name "Druids" for the Welsh bards should be dropped. It is retained at the Gorsedd as the name of one of the three classes of members. There is very little authority for calling the presiding bard archdruid. The proper name is *Priv-vardd*, Chief Bard. Let "Druids" and "Druidism" remain as general terms for the use of the "pre-historian." The Welsh bards insist on a grander name, *Gorsedd Beirdd Ynys Prydain*, the high court of the bards of the Isle of Britain.

(2) As to the May year, it has not become obsolete in Wales. There is practically no other in our ancient literature. Its omission from the conventional Gorsedd instructions, while it is everywhere present in the bardic traditions with that exception, is, I think, due to monastic influence. The Church year became solstitial. The bards fraternised with the monks, and Gorsedds were held in chapter-houses and churches. One result was that the bards adopted the festival year as fixed by the Church, so that the favourite time for a Gorsedd was neither solstitial nor agricultural, but such a time as Whitsuntide. This, the only serious meddling with the traditions that I can find, was done, say, about the twelfth century, when the Cistercian monks of Margam, Glam., where the Gorsedd traditions were chiefly preserved, found a new use for the Gorsedd, as a model for the round or polygonal chapter-house.

(3) It is not likely that a stone circle can be found exactly like a Welsh Gorsedd. In the earliest traditions, like those of the oldest Mabinogion, we seem to find the temple observatory in actual use, say, by the Druids; but, speaking generally, in the Gorsedd traditions themselves it is only a matter of minor importance, preserved as well as such a comparatively useless thing could be for the sake of some sacred associations. Modern bards do not understand the plans they have preserved. When a new Gorsedd is set up, no account is taken of the height of the horizon in the direction of the sunrise stones, a matter of much importance to the builders of the megalithic monuments. The bards have religiously preserved the general plan. At some point of time, when it was deemed necessary to preserve such a thing after it had ceased to be of practical use, the bards did better than copying any individual monument, which, as a rule, gives only one decisive sight-line to sunrise or sunset. They set up a complete almanac in stone. The perfect plan I have directed attention to (NATURE, May 2) presents sight-lines to the quarter days of both the solstitial and May years. As the individual monument is usually oriented to some one festival day, uniformity in detail is not to be looked for. The Gorsedd presents in one plan the combined sunrise sight-lines of all the circles in fair preservation that have been astronomically surveyed.

(4) The form of the central stone is immaterial in discussing the plan. At a temple observatory, what was chiefly necessary was to mark the exact centre of the circle. Where no "cove" was erected, an upright stone would suit well. Where neither was present, the priest-astronomer would simply stand on the spot to make his observations. The present fashion of placing a large boulder on the flat in the centre of the Gorsedd seems reminiscent of both the "cove" and the later kist.

(5) "Myfyr Morganwg" is only to be followed so far as he can produce some earlier authority. He tried to mix the contents of the "Asiatic Researches" with those of Welsh tradition. I have before me a plan of the Pontypridd circle, published in the second quarter of the last century, in which the three station stones, or sunrise stones, form alignments to the equinox, May, and November.

(6) The bards were not allowed to sit in a Gorsedd; they were to stand uncovered, head and feet.

(7) I did not mean that the process of "re-codifying or otherwise dealing with the bardic traditions" was in operation only from the twelfth to the nineteenth century. It seems very likely that there was a larger body of Gorsedd traditions known in the twelfth century than we find at any subsequent period. Again, I applied the epithet "voluminous" to the whole stock of printed and manuscript materials on the subject still extant. They have "grown," not to any large extent by addition or accretion, but by the multiplication of versions or recensions of what was recited at the Gorsedd meetings, as was the fixed rule. There is much work to be done by way of collating these recensions. I have an impression that the recital of the Gorsedd traditions proper would not have occupied a longer time than an old-time sermon. The only considerable additions concern the rules of poetry. There is no evidence, except the indirect evidence respecting the solstitial year, that the conventional instructions about the Gorsedd circle itself have been subjected to any revision. This is distinctly stated to be a matter of minor importance—the circle with its ceremonies. The following words, translated from a Welsh extract from an old book at Raglan Castle, before that place was destroyed by Cromwell's forces, shows the attitude of the bards towards the subject here under discussion:—

"Now follows an account of things that appertain to institutional ceremonies, and that accord with the reason and inheritance observable in the reminiscence and customs of the bards of the Island of Britain; but which, nevertheless, are not considered as indispensably requisite parts of the system; because every truth and knowledge—every recollection and intention—as well as every art and science, may be acquired without them:—still they corroborate and illustrate reminiscences and primary regulations; for which reason, it is deemed laudable to perpetuate them in memory and usage; especially as they comprise the ancient forms transmitted, by the retentive memory of Gorsedd" ("Iolo MSS.," p. 445).

Then the scribe begins the list of non-essentials as follows:—"It is an institutional usage to form a conventional circle of stones, on the summit of some conspicuous ground," and he gives complete details. This is not the tone of a scribe who was conscious of any weakness in the traditional account.

I take no serious exception to anything that Mr. Lewis says. He has himself furnished very valuable data for this inquiry. But a better theory than an "accidental sort of way" must be found to explain highly finished and polished statements which, like pebbles in glacial drift, speak of the remotest origin.

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## MARINE ZOOLOGY AT THE CAPE.<sup>1</sup>

THE third volume of reports on the Cape marine fauna contains ten papers published between 1904 and 1905. Of these memoirs, two dealing with eighteen new species of fish and the development of South African fishes, are by Dr. Gilchrist, to whose enterprise and ability these sustained and extended investigations of the resources of the Cape seas are largely due. In this work he has been ably seconded by European colleagues. Prof. McIntosh contributes two papers on the polychæt annelids; Prof. Hickson a second report on the Alcyonaria; Prof. Jeffrey Bell three contributions, dealing respectively with the echinoid, asteroid, and ophiuroid echinoderms; Mr. Stanley Gardiner publishes a careful study of the turbinolid corals; and Prof. Cleve submits a first instalment of a study of the South African marine plankton.

Dr. Gilchrist's second contribution to a knowledge of the life-histories of the Cape fish contains several matters of interest, although he has only succeeded in referring nine of the eighteen stages or eggs he describes to known species. The development of the saury-pike (*Scombresox saurus*) is worth noticing for

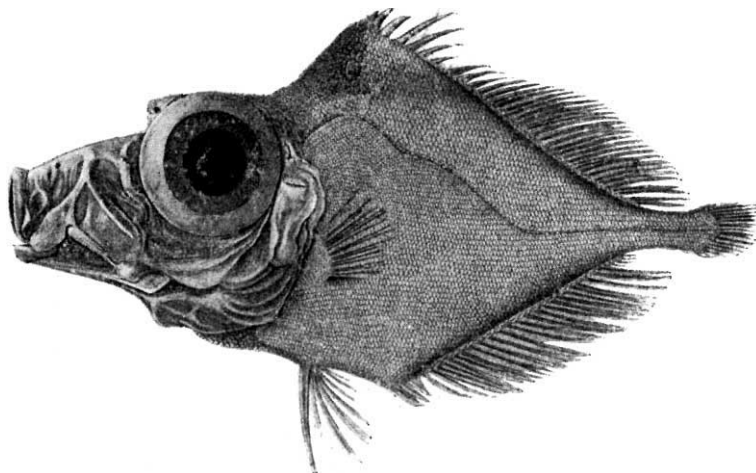


FIG. 1.—*Cytosoma Boops*, ng. eb sp. From "Marine Investigations in South Africa."

two reasons. In the first place, the young fish before hatching keeps up a rapid and almost constant movement of one pectoral fin, and when hatched, keeping its tail well submerged, it skims the surface with its mouth as if in search of food. The second peculiarity of the saury, if well founded, is of greater interest, and consists in the presence of blue pigment arranged in chromatophores, massively developed on the dorsal surface and sparsely below. The presence of an indubitable blue pigment concentrated in cellular elements is probably a new fact in animal coloration, and one that suggests how wide a field of investigation is afforded by the phenomena of pigmentation in fish. Another noteworthy feature of this article is the account of cannibalism prevalent among the unborn young of *Cataetys messieri*. It appears that this deep-sea fish is viviparous. In the one case described, the right ovary consisted of a mass of undeveloped bright red eggs with a single larva coiled up in a dense mucous substance, whilst the left ovary contained seven larvæ also strongly flexed and embedded in mucus. When these were detached it

<sup>1</sup> Cape of Good Hope, Department of Agriculture. "Marine Investigations in South Africa." Vol. iii. Pp. 269+45 plates. (Cape Town: The Cape Times, Ltd., 1905.)